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CANADIAN FOSSILS,

CONTAINING DESCRIPTIONS OF

NEW GENERA AND SPECIES,

FROM THE

SILURIAN AND DEVONIAN FORMATIONS
OF CANADA;

WITH SOME SPECIES PREVIOUSLY DESCRIBED, BUT NOW FOR THE
FIRST TIME INDICATED AS OCCURRING IN CANADA.

BY E. BILLINGS.

(Extracted from the Report of the Geological Survey of Canada for the year 1857.)

Montreal:

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SILURIAN AND DEVONIAN FOSSILS OF CANADA.

Genus FISTULIPORA (McCoy).

(McCoy, *British Palaeozoic Fossils*, p. 11.)

Generic Characters.—"Corallum incrusting, or forming large masses, composed of long, simple, cylindrical, thick-walled tubes, the mouths of which open as simple, equal, circular smooth-edged cells on the surface, and have numerous transverse diaphragms at variable distances; intervals between the tubes occupied by a cellular network of small vesicular plates, or capillary tubules traversed by diaphragms."

This genus has no radiating lamellæ, a character which constitutes the only difference between it and *Heliolites* (Dana.)

1. FISTULIPORA CANADENSIS (Billings).

Description.—Corallum forming irregular, contorted masses, or wide, flat, undulating expansions or layers from one-half of an inch to one inch in thickness, which are based upon a thin, concentrically wrinkled epitheca. Cell-tubes half a line or less in diameter, and about one line distant from each other; the mouths of the tubes protruding a little above the general surface. Transverse diaphragms thin, horizontal or flexuous, and sometimes very numerous, there being in some of the tubes three or four in half a line of the length of the tube. The in-

tercellular tubules are polygonal, and about four in the diameter of one of the principal cells; their transverse diaphragms are well developed, usually four or five to one line of the length.

F. Canadensis differs from the other described species in the following respects:—From *F. decipiens* (McCoy) in having the cell-tubes more distant and the diaphragms more numerous, and from *F. minor* (McCoy) in the same particulars, the cell-tubes of the latter species being still smaller and closer together than in *F. decipiens*.

This coral much resembles *Heliolites porosa* (Goldfuss), but can be readily distinguished by the absence of the radiating septa.

Locality and Formation.—Devonian; Corniferous or Onondaga limestone; lot 6, con. 1, Township of Wainfleet; at the east end of Lake Erie.

Collector—A. Murray, Esq.

Genus COLUMNARIA (Goldfuss).

Generic characters.—Composed of large masses of elongated sub-parallel corallites, which when separate are round, but when in contact polygonal. Radiating septa either rudimentary, or well developed, sometimes reaching the centre. Transverse diaphragms numerous, usually complete, and either horizontal, oblique or flexuous.

COLUMNARIA GOLDFUSSEI (Billings).

Description.—This species is found in large amorphous or sub-globose masses composed of long straight or flexuous polygonal corallites with an average diameter of about half a line; transverse diaphragms from four to six in a line; radiating septa rudimentary, but distinctly striating the interior walls.

Formation and Locality.—Hudson River group? Snake Island and Traverse point, Lake St. John.

Collector.—J. Richardson.

COLUMNARIA BLAINVILLI (Billings).

Description.—Forming large sub-globose pyriform or hemispheric masses of polygonal corallites one line and a-half in diameter; about eighteen radiating septa which reach the centre; transverse diaphragms three or four to one line.

The radiating septa in fractured specimens where the interiors of the tubes are well exposed, striate the surface exactly as in *Columnaria alveolata*, from which species and from *Favistella stellata*, Hall, it only differs by its smaller size.

Formation and Locality.—Hudson River Group. Snake Island, Lake St. John.

Collector.—J. Richardson.

COLUMNARIA RIGIDA (Billings).

Description.—Forming large masses of polygonal corallites, usually three lines in diameter, but with numerous smaller ones, and others of a larger size; radiating septa, about twenty reaching the centre; transverse diaphragms from two to three line.

This species resembles *C. alveolata*, but differs in the greater development of the radiating septa which extend about half-way to the centre. The tubes are also about the same size as those of *Favistella stellata*, Hall, which differs in the septa not only reaching the centre, but also in their often being so strongly developed there, as to produce by their junction the appearance of a pseudo-columella.

Formation & Locality.—Hudson River group? Lake St. John.

Collector.—J. Richardson.

COLUMNARIA ERRATICA (Billings).

Description.—Forming large masses of corallites either in contact or separate. The separate cells are round, those in contact more or less polygonal, the radiating septa rudimentary, forming about four sulci in the breadth of one line upon

the interior; diameter of corallites from two to five lines, in general about three and a-half lines. The transverse diaphragms are not visible in the specimens examined. The walls of the separate corallites are thick and concentrically wrinkled.

One specimen with corallites two lines in diameter appears to be a variety of this species.

Formation and Locality.—Trenton; Blue Point, Lake St. John.

Collector.—J. Richardson.

Genus PALÆOPHYLLUM (Billings).

Generic characters.—Corallum fasciculate or aggregate; corallites surrounded by a thick wall; radiating septa extending the whole length; transverse diaphragms either none or rudimentary; increase by lateral budding.

This genus only differs from *Petraia* or *Strepelasma* by forming long fasciculate or aggregate masses instead of being simple.

PALÆOPHYLLUM REGOSUM (Billings).

Description.—Corallum in large aggregations of scarcely separate corallites, which where they open out upon the surface of the rock are from one to six lines in diameter, the average adult size being about four lines. Radiating septa reaching the centre; about twenty-two septa in a corallite four lines in diameter, with an equal number in a rudimentary state between.

The great disparity in the size of the tubes in the same mass is owing to the mode of increase and gradual growth of the young corallites. These, of all sizes from one line in diameter and upwards, are uniformly intermingled with the adult individuals.

Formation and Locality.—Trenton; Lake St. John, Little Discharge.

Collector.—J. Richardson.

PETRAIA RUSTICA (Billings).

Description.—Straight or slightly curved, covered with a strong epitheca, which is more or less annulated with broad shallow undulations; radiating septa about one hundred or usually a little more; much confused in the centre, where they form a vesicular mass; every alternate septum much smaller than the others, only half the whole number reaching the centre. Length from two inches and a half to three inches and a half. Diameter of cup one inch to one inch and a half; depth of cup half an inch or somewhat more.

This species appears to be the same as that described by Edwards and Haime under the name of *Streptelasma corniculum*. The true *S. corniculum* of Mr Hall is a very different species, being always shorter and much curved.

Formation and Locality.—Fladson River group; Snake Island, Lake St. John.

Collector.—J. Richardson.

Genus SYRINGOPORA (Goldfuss.)

Generic characters.—The fossils of this genus are fasciculated or composed of large aggregations of long cylindrical corallites somewhat parallel to each other and connected by numerous smaller transverse tubes. The exterior walls consist of a well developed solid epitheca; the cells circular; radiating septa rudimentary; transverse diaphragms infundibuliform or placed one within another like a series of funnels.

About twenty species of this genus are known, and these are found in the Upper Silurian, Devonian and Carboniferous formations.

SYRINGOPORA DALMANII (Billings).

Description.—Forming large masses; corallites long sub-parallel, slightly radiating, occasionally a little flexuous, annulated, one line or rather more in diameter, distant usually half a line, occasionally in contact or where flexures occur, more

than one line apart; connecting processes very short, about two lines distant.

Formation and Locality.—Upper Silurian, Head of Lake Temiscaming.

Collector.—Sir W. E. Logan.

SYRINGOPORA COMPACTA (Billings).

Description.—Forming large hemispherical masses of straight parallel or slightly diverging corallites, which are so closely aggregated as to compose a nearly solid mass; about six corallites in two lines.

This species differs from all others of this genus hitherto described in the closeness of the corallites. These are so small, straight and closely united that large masses broken in the longitudinal direction of the tubes have the aspect of some species of *Monticulipora*.

Formation and Locality.—Upper Silurian. L'Ance a la Vieille, Gaspé.

Collector.—Sir W. E. Logan.

SYRINGOPORA VERTICILATA, (Goldfuss.)

(Goldfuss, *Petr. Germ.*, vol. i. p. 76, note 25, 26.)

Description.—Forming large masses, corallites nearly straight, about two lines in diameter, and from two to three lines distant; connecting tubes three or four lines distant, verticillating, or three or four radiating from the tube at the same level in different directions, like the spokes of a wheel.

Formation and Locality.—Upper Silurian. Head of Lake Temiscaming. Goldfuss specimens were from Lake Huron.

Collector.—Sir W. E. Logan.

SYRINGOPORA RETEFORMIS (Billings).

Description.—Forming large masses; corallites much geniculated, frequently anastomosing or connecting by stout processes; diameter of corallites about two-thirds of a line, distant

from each other from half-a-line to a line and a-half; distance of connecting processes one line to three lines, usually about two lines.

Formation and Locality.—Upper Silurian. Isihmus Bay; Lake Huron.

Collector.—A. Murray.

SYRINGOPORA DEBILIS (Billings).

Description.—Corallites a little more than half a line in diameter, distant one or two diameters; connecting processes slender, distant one or two lines.

Formation and Locality.—Upper Silurian; L'Anse à la Vieille.

Collector.—Sir W. E. Logan.

SYRINGOPORA TUBIPOROIDES, (Yandell and Shumard.)

(*Contributions to the Geology of Kentucky*, page 8; 1847.)

(M. Edwards and L. Haime, *Polypiers fossiles des terrains paléozoïques*, p. 292.)

Description.—This species is found in large masses of long slightly flexuous corallites. These have a diameter of about one line and a-half, and owing to their flexuosity, are at times in contact, and often two, three or four lines a part. In large colonies which have grown luxuriantly without the interference of disturbing causes, the corallites are more regular than in the smaller or stunted groups, in which the corallites are much bent and confused. The connecting processes are very short and distant, and appear to be sometimes mere inosculation of the stems. The corallites after growing separately for a short distance, approach each other and seem to grow together or adhere to each other for the space of a line and a-half or more, they then diverge and again unite. These points of contact occur at distances varying from three lines to six, nine, or even twelve lines. Externally they exhibit numerous other indistinct annulations, and also faint indications of longitudinal striae.

Formation and Locality.—Devonian; abundant in the Corniferous limestone of Canada West.

Collectors.—A. Murray, E. Billings.

SYRINGOPORA NOBILIS (Billings).

Description.—Corallites three lines in diameter, distant two to four lines. The connecting processes in this species have not been observed, but the size of the corallites is quite sufficient to separate it from any known species.

Formation and Locality.—Devonian; Corniferous limestone, near Woodstock Canada West.

Collector—A. Murray.

SYRINGOPORA ELEGANS (Billings).

Description.—Corallites, one line in diameter, sometimes a little more or less, distant a little less than one line; connecting tubes half a line in diameter, and distant from one line to one line and a half, usually projecting at right angles, but sometimes a little oblique. Epithea with numerous annulations, generally indistinct, but under certain circumstances of growth sharply defined and deep, so much so as to give to the corallites the appearance of the jointed stalk of a crinoid. The young individuals are produced by lateral budding, and in one specimen examined the whole colony appears to be based upon a broad lamellar foot secretion like that which forms the base of a Favosite.

The distance of the corallites is usually about a line, but like all the other species, this one varies a good deal in this respect. When some cause has intervened to prevent their regular growth they are much flexed and consequently at times more distant than when they have been disturbed. The connecting tubes on the same side of the corallite are three or four lines distant, but generally on the other sides one or two others in the same space occur, making the average distance one line or one line and a half.

Formation and Locality.—Devonian; Corniferous limestone, near Woodstock Canada West.

Collector—A. Murray Esq.

SYRINGOPORA HISINGERI (Billings).

Description.—This specie forms large masses of very long, nearly parallel or slightly varying, slender corallites, which are closely aggregated and present a rugged or knobby appearance from the great number of the connecting tubes. The diameter of the corallites is one-third of a line, or a little more. The tubes of connection are distant from two-thirds of a line to one line and a-half. The distance between the corallites is for the greater part less than their diameter. The young corallites branch from the sides of the adult individuals, and immediately become parallel with the parent, and connected with it again by the usual tubes of connection.

Formation and Locality.—Devonian; Corniferous limestone, Canada West. (common.)

Collectors—A. Murray and E. Billings.

Affinities of S. Hisingeri.—Edwards and Haime have described two species from Ohio, collected in rocks of the age of the Onondaga and Corniferous limestones, which appear to be closely allied to this; the following are their descriptions:

“SYRINGOPORA VERNEULLI.—Corallites long, distance between them twice or thrice their diameter, subflexuous and angular at the points of the origin of the tubes of connection, these are distant two or three millimetres; diameter of the corallites two-thirds of a millimetre.”—Devonian, Columbus, Ohio. (*Polypters Fossiles*, p. 289.)

“SYRINGOPORA CLEVIANA.—Corallites slightly flexuous, distant once or twice their diameter, which is two-thirds of a millimetre.”—Devonian, Carolton and Dayton, Ohio. (*Polypters Fossiles*, p. 295.)

The first of these species is different from *S. Hisingeri* in the greater distance of the corallites. The description of the second is too incomplete to enable us to decide whether it refers to the same species or not. The authors state that their specimen was imperfect, and that they were not certain that it had not been previously described.

Genus MICHELINIA (De Koniack).

Generic Characters.—"Corallum compound, forming rounded, or conoidal masses of inseparably united, thick-walled, polygonal tubes of large size, marked internally with numerous vertical lamellar striæ, and communicating pores; base of cells filled up by very irregular, numerous, highly inclined vesicular plates, not forming distinct horizontal diaphragms; external or basal epitheca of the general mass, strong, concentrically wrinkled, and sometimes spinose."—McCoy, *British Palæozoic Fossils*, page 80.

This genus differs from Favosites in the vesicular character of the transverse diaphragms, and in the radiating lamellæ being represented by vertical striæ on the inner surface of the cells, instead of series of minute spines. The cells are usually much larger than in Favosites. The genus appears to be confined to the Devonian and Carboniferous formations.

MICHELINIA CONVEXA (D'Orbigny).

(*Prodr. de Paleont.*, t. 1, p. 107, 1850.)

Description.—Corallum forming hemispherical, or erect rudely cylindrical masses, several inches in diameter; the base covered by a strong wrinkled epitheca. Adult calices from four to five lines in diameter; about forty septal striæ in each; pores small, arranged in several vertical series in some of the tubes, irregularly distributed in others; distant from half a line to more than one line. Diaphragms very convex in the centre of the tubes, and usually with three or four smaller rounded prominences on their surface; a vertical section shews that they are more vesicular at the sides of the cells than in the centre, where they are from half a line to one line and a-half distant.

MM. Edwards and Haime in their description of this species say that there are two vertical series of pores on the larger plane sides of the cells and one on the smaller. Our specimen, however shew that this is not a constant character.*

* See Polypiers Fossiles des Terrains Palæozoïques, page 251.

Formation and Locality.—Devonian; Onondaga and Corniferous limestones. Rama's farm, Port Colborne. Savage's quarry, lot 6, con. 1, Wainfleet. Oxford, near Woodstock and in numerous other localities in Western Canada. This species occurs in Michigan and in Preston County, Virginia.

MICHELINIA INTERMITTENS (Billings).

Description.—Corallum forming large hemispherical masses; calyces nearly equal in diameter, with periodical constrictions within at the distance of half a line to one line and a-half. Diaphragms numerous, thin, slightly convex, sometimes shewing four or five vesicular swellings upon a single surface. The septal striæ are but slightly developed, about fifty to the inner circumference of the cell. Pores only visible in the intervals between the constrictions where the walls are thin, three or four series on each plane side of the tube. The cells are from three to four lines in diameter.

The constrictions give to the cells of this species a circular aspect, whereas they are in fact polygonal. I am not certain that this fossil is different from the species described by Edwards and Haime (op. cit. p. 299,) under the name of *Chonostegites Clappi*. If so it should I think be called *Michelinia Clappi*, as it exhibits all the characters of *Michelinia*. The constrictions appear to be occasioned only by the periodical thickening of the walls of the cells. Where not constricted the cells have the usual prismatic shape, with pores and septal striæ.

Formation and Locality.—The only specimen I have seen was collected by Mr. Murray, near Woodstock, C. W. It was found loose, but in lithological characters, it resembles the other species from the Corniferous limestone of that region.

MICHELINIA FAVOSOIDEA (Billings).

Description.—Corallum forming large hemispheric or flattened masses; cells unequal in size, adult diameter about two

lines and a half; diaphragms, flat, horizontal, with small vesicular swellings, usually around the margins of the upper surface; septal striae very obscure, six to eight on each plane side of the cells; pores, very small, irregularly distributed, sometimes in rows of five or six across the cell, about one-sixth of a line distant from each other in some places, and sometimes absent in spaces of half a line in width. This species has much of the aspect of *Favosites favosa*, Goldfuss, but is notwithstanding very clearly a true *Michelinia*.

Formation and Locality.—Corniferous. Rama's farm, Port Colborne.

Collector.—E. Billings.

GENUS ZAPHRENTIS (Rafinesque).

Generic Characters.—Corallum simple, elongated, free and turbinated, surrounded by a complete epitheca; cup more or less deep; no columella?; a single fossette well developed and occupying the place of one of the radiating septa; these are in general well developed, denticulated upon their margins, and extend upon the surface of the transverse diaphragms to the central of the visceral chambers.

Edwards and Haime in the *Polypiers Fossiles*, page 326, have in substance given the above definition of this genus. In some of the species there is a rudimentary columella, and sometimes even in the same species the radiating septa may or may not reach the centre in different individuals.

ZAPHRENTIS PROLIFICA (Billings).

Description.—Corallum simple, turbate, curved, with a few broad shallow encircling folds. Septal fossette of a pyriform shape, gradually enlarging from the margin towards but not quite reaching the centre, variable in its position in relation to the curvature of the fossil. Radiating septa in the adult specimens between sixty and seventy-five of the larger size, alternating with a like number of smaller ones, the former in some of the individuals extending to the centre on the bottom

of the cup, where they are spirally twisted or irregularly contorted, in other specimens not reaching the centre, which is then occupied by a smooth space or often with a columella elongated in a direction from the septal fossette towards the opposite side. The septa are also sharp-edged for about half the distance from the bottom of the cup to the margin, then become gradually less projecting until at the edge of the cup they are reduced to mere flat rounded ridges. Length from four to five inches or a little more. Width of cup from two inches to two inches and a half. Depth of cup about one inch.

Very numerous specimens of young individuals of this species, one inch and a-half and upwards in length, and with fifty or more principal radiating septa occur along with those full grown. These small ones might perhaps be regarded as constituting distinct species, but when good specimens can be observed they all exhibit the characters which are persistent in the large individuals.

The presence of the columella seems at first sight to be a sufficient ground for placing the individuals in which it occurs in the genus *Lophophyllum* (Edwards and Haime). I have however examined a great number of specimens and have found every gradation between the following characteristics.

1st. Specimens with a perfectly smooth space in the bottom of the cup, no columella.

2nd. With a columella slightly developed.

3rd. Columella large and prominent, with a smooth space all round.

4th. Columella well developed, but with a number of irregular often elongated tubercles in the surrounding smooth space.

5th. The septa reaching the columella, no smooth space.

6th. Septa covering the columella.

7th. Septa reaching the centre, with the columella either prominently, slightly or not all indicated beneath.

This last mentioned form must certainly be regarded as a true *Zaphrentis*, all other characters of the genus being present,

and from it there is a regular series of forms leading in the seven directions above indicated or more. It appears to me therefore that so far from these specimens being divisible into several genera they only constitute one species.

The most persistent characters are the rounded edges of the septa near the margin of the cup, and the oval shape of the septal fossette, in the bottom of which where it reaches the side of the cup is a single septum which projects a little and partially divides the fossette.

This species somewhat resemble *Z. cornicula* (Lesueur), but differs in the edges of the septa, which are not dentated as in that species.

Formation and Locality. Devonian; Corniferous limestone. Extremely abundant at Rama's Farm near Port Colborne, Canada West.

ZAPHRENTIS SPATIOSA (Billings).

Description.—Corallum short, turbinate, moderately curved and very broadly expanding. At the margin of the cup about ninety radiating septa alternately a little unequal and with their edges broadly rounded as in *Z. prolifica*. Length measured on the side of the greater curvature, about three inches, width of cup two inches and a-half. Septal fossette unknown.

This species is closely related to *Z. prolifica*, and may perhaps be united with it when its characters become more fully known.

Formation and Locality.—Devonian, Onondaga and Corniferous limestones, Rama's Farm, near Port Colborne Canada West.

Genus CYSTIPHYLLUM (Lonsdale.)

Generic Characters.—Corallum simple, turbinate, entirely filled with vesicular celluliferous structure; radiating septa, rudimentary or obsolete.

CYSTIPHYLLUM SULCATUM (Billings.)

Description.—Short, turbinate, much curved, expanding at the rate of between forty and forty-five degrees from the minute sharp curved point upwards; cup oblique, the lower margin being on the side of the lesser curvature, moderately deep and nearly regularly concave, the bottom covered with obscure coarse rounded radiating ridges; a shallow rounded groove or fossette extending from the centre to the higher margin, and in some specimens two others much less distinct radiating to the sides at right angles to the main groove. Exterior encircled by obscure undulations, and longitudinally striated by the rudimentary radiating septa. The vesicular structure consists of irregular sub-leucular cells from half a line to two lines in width; length of the convex side from one inch and a half to three inches, the usual length appears to be about two inches or a little more; width of cup from one inch to one inch and a half; depth about half an inch.

This species when the interior cannot be seen might be mistaken upon a superficial examination for a small curved *Cyathophyllum* or *Zaphrentis*. It is about the size and shape of the curved specimens of *Petraia cornicula*.

Locality and Formation.—Rather common in the Corniferous or Onondaga limestone on Rama's farm, Port Colborne.

Collector—E. Billings.

Genus CYRTODONTA (Billings).

Generic Characters.—Equivale, inequilateral; umbones near the anterior end; general form obliquely tumid, transversely sub-rhomboidal or ovate, posterior extremity larger than the anterior and usually broadly rounded; two muscular impressions, of which the posterior is superficial and the anterior sometimes deeply excavated; three oblique, often more or less curved, anterior teeth, situated either beneath or a little in front of the umbones; two or three remote posterior lateral teeth parallel with the hinge line; pallial line simple; liga-

ment external; some of the species have a narrow area between or behind the beaks.

CYRTODONTA RUGOSA (Billings).



Fig. 1.

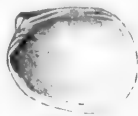


Fig. 2.

Figure 1. Exterior of right valve.

" 2. Interior of same specimen.

Description.—Small, sub-rhomboidal or sub-quadrate, the dorsal and ventral margins being somewhat parallel, and the anterior and posterior extremities obtusely rounded, the latter broader than the former; obliquely tumid from the beaks to the posterior ventral angle; the beaks rather small and incurved; a broad, shallow, scarcely perceptible depression extending from the ventral margin obliquely forward and upward towards the umbones; surface concentrically striated, and also marked with several more or less prominent sub-imbricating concentric ridges of growth; hinge line nearly straight, a little curved; interior shewing in the right valve three anterior teeth, the central one of which is the largest, and two posterior lateral teeth. In the left valve there appear to be four anterior teeth; but as the specimens are somewhat imperfect, this may not be the correct number. Width nine lines; length from the centre of the hinge line to the centre of the ventral margin, seven lines; depth of a single valve, three lines.

None of the specimens that I have seen are larger than the one represented in figures 1 and 2.

Locality and Formation.—Fourth Chute of the Bonne chère, Pauquette's Rapids, and at La Petite Chaudière Rapids near the city of Ottawa north side, associated with numerous fossils of the Trenton and Black River formations.

Collectors—Sir W. E. Logan, J. Richardson, E. Billings.

CYRTODONTA HURONENSE (Billings).



Fig. 3.



Fig. 4.

Figure 3. View of left valve from Lake Huron.

" 4. Interior of another specimen, same locality.

Description.—Transversely oval; anterior and posterior extremities rounded; ventral margin moderately convex, dorsal margin a little more convex than the ventral; umbones rather small, incurved; greatest tumidity extending from the umbones obliquely towards the posterior ventral angle; surface concentrically marked with fine striæ and ridges of growth. Width one inch five lines; length at the centre, one inch.

Locality and Formation.—The specimens are from an island in the group lying off Point Palladeau, Lake Huron, where they were found associated with Chazy, Black River and Trenton fossils; also at Point Claire, Island of Montreal.

Collector.—A. Murray.

CYRTODONTA SUBCARINATA (Billings).



Fig. 5.



Fig. 6.



Fig. 7.

Figure 5. A specimen from Pointe Claire.

" 6. Dorsal view of same specimen.

" 7. A cast from lot 26, con. 5, Osnaeruck.

Description.—Transversely sub-oval; ventral margin scarcely convex, straight or slightly sinuated for a small space of the centre; dorsal margin elevated in the centre and sloping with a slight curve towards the posterior end, which is narrowly rounded, or truncate in the casts of the interior; umbones moderately small, incurved, and somewhat carinate for a greater or less distance; surface marked with obscure concentric ridges of growth. The interior has not been seen. Width one inch three lines; length nine lines.

This species may perhaps be considered a variety of the last; but the proportions are somewhat different, and it is always characterised by the strong, rounded carina, which extends from the umbones to the posterior ventral angle.

Locality and Formation.—Occurs at Pointe Claire and in numerous localities in the valley of the Ottawa in the top of the Chazy, throughout the Birdseye and Black River limestones, and in the base of the Trenton.

Collectors—Sir W. E. Logan, A. Murray, J. Richardson, E. Billings.

CYRTODONTA CANADENSIS (Billings).

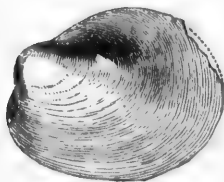


Fig. 8.



Fig. 9.

Figure 8. A small specimen from the north side of St. Joseph's Island, Lake Huron.

" 9. An elongated variety from the lower beds opposite the foot of the timber-slide, 4th Chute of the Bonne chère.

Description.—Transversely broad-oval; anterior, posterior, and ventral margins, and also the posterior half of the dorsal margin regularly rounded; a portion of the ventral margin about the centre of the width is sometimes nearly straight;

dorsal margin elevated, somewhat compressed; diagonally and rounded ventricose from the umbones towards the posterior ventral angle; beaks short, obtusely rounded, incurved;

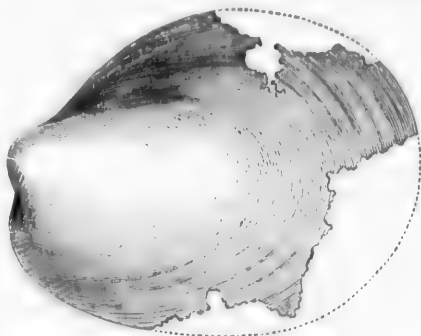


Fig. 10.

Fig. 10. A large specimen from Pauquette's Rapids.

surface nearly smooth or obscurely marked with concentric ridges; a few strong imbricating lamellæ of growth near the margin of some specimens. Depth from fifteen lines to two inches and one-fourth; length from eleven lines to twenty-one lines.

Some of the specimens are a little more transverse than others; but there are intermediate forms connecting the specimen, represented by Figure 9, with Figures 8 and 10.



Fig. 11.

Fig. 11. A fragment, showing the anterior teeth.

The anterior teeth are short, the central one being the longest and the most curved; the posterior teeth of the specimen represented by Fig. 10 are two in number, elongated and prominent.

Locality and Formation.—Island of St. Joseph's Lake Huron; La Petite Chaudière Rapids near the City of Ottawa; Fourth

Chute of the Bonne chère and Pauquette's Rapids ; associated with fossils of the Trenton and Black River formations.

Collectors—Sir W. E. Logan, J. Richardson, A. Murray, E. Billings.

CYRTODONTA SPINIFERA (Billings).

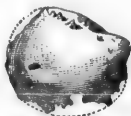


Fig. 12.

Description.—Small, sub-circular ; greatest length and breadth about equal ; moderately convex ; hinge line much elevated ; umbones small, incurved ; dorsal margin nearly straight from the umbones about half-way to the posterior extremity of the hinge line ; anterior, ventral, posterior and posterior half of dorsal margins broadly and regularly rounded ; surface smooth, with a few short stout spines.

The specimen figured shews the anterior teeth : they are three in number, and do not differ from those of *C. rugosa*. Length eight lines ; breadth the same.

Locality and Formation.—Pauquettes Rapids, and Fourth Chute of Bonne chère, associated with fossils of the Trenton and Black River formations.

Collectors—Sir W. E. Logan, J. Richardson, E. Billings.

CYRTODONTA OBTUSA (Hall sp.)

(*Ambonychia obtusa*, Hall, Palæontology of New York. Vol. 1, p. 167. Plate 36 ; Figures 8a, 8b.)

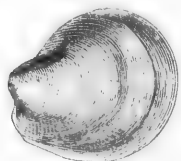


Fig. 13.

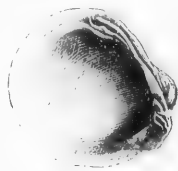


Fig. 14.

Figure 13. Left valve from Pauquette's Rapids.
" 14. Interior of same shewing the teeth.

Description.—The following is Professor Hall's description :
 "Obliquely ovate, short, gibbous; umbones short, obtuse, scarcely incurved or bending forwards; shell somewhat compressed towards the lower margin, convex on the centre and becoming inflated above; anterior side obtuse, rounded, scarcely extending beyond the umbones; posterior side compressed, scarcely alated; cardinal line straight, margin of shell curving from its posterior extremity; surface?"

"The specimens seen are casts, where the markings of the shell are not preserved. This species is distinguished from the others by its short, ovate form, as well as the shorter, very obtuse and gibbous umbones. It departs somewhat from the typical forms of the genus (*Ambonychia*); but it has nevertheless the essential features, and cannot be referred to any other genus." (Pal. N. Y., vol. 1, page 167.)

Locality and Formation.—City of Ottawa, Belleville, and at Trenton on the Bay of Quinte, in the Trenton limestone; at the Fourth Chute of the Bonne chère, and also at Pauquette's Rapids very perfect specimens are common, associated with fossils of the Trenton and Black River formations.

Collectors.—Sir W. E. Logan, J. Richardson, and E. Billings.

CYRTODONTA SUB-TRUNCATA (Hall sp.).

Edmondia sub-truncata, Hall, Palæontology of New York, Vol. i., page 156, Plate 35, Figure 3 c, (not Fig. 9, Plate 34.)

This species is common in the Trenton and Black River limestones of Canada at all the localities above mentioned. The silicified specimens shew the internal characters of *Cyrtodonta* very clearly.

CYRTODONTA SUB-ANGULATA (Hall sp.).

Edmondia sub-angulata, Hall, Palæontology of New York, Vol. i., page 156, Plate 35, Figures 2 a, b.

A specimen of this species from Pauquette's Rapids exhibits in the right valve two posterior lateral teeth and an area between the beaks. That portion of the hinge line occupied by the anterior hinge teeth is destroyed, so that their character

cannot be observed. There is an anterior muscular impression as in the other species.

It occurs at Pauquette's Rapids and at La Petite Chaudière.

CYRTODONTA CORDIFORMIS (Billings).

Description.—Sub-rhomboidal; cordiform; extremely ventricose; umbones strongly incurved; obtusely carinate on their upper side; the carination extending backwards and diagonally downwards, becoming more rounded and nearly obsolete before reaching the posterior ventral angle; the hinge-line is straight, short, and about at right angles to the direction of the carina; from the extremity of the hinge-line the posterior side slopes abruptly, but with a moderate curve, to the posterior ventral angle; ventral margin a little convex, and about as long as the posterior side; anterior margin half the length of the ventral, not much curved; anterior muscular scar oval and distinctly marked; surface concentrically striated. Length of largest specimen examined from the beaks to the posterior ventral angle, thirteen lines; length of hinge-line, seven lines; length of posterior and ventral sides, about ten lines each. The diagonal carina is not straight, but has a strong upward curve.

Locality and Formation.—East point of St. Joseph's Island, Lake Huron, Trenton Limestone.

Collector.—A. Murray.

CYRTODONTA SIGMOIDEA (Billings).

Description.—Sub-rhomboidal, ventricose, a strong obtusely angular carina extending from the closely appressed beaks with a sigmoid curve to the posterior ventral margin; anterior end rounded, projecting a little in front of the beaks; ventral margin longer than the dorsal and moderately convex; posterior extremity obliquely truncate. Width one inch and a half; length from the umbones to the ventral margin thirteen lines.

Locality and Formation.—Hudson River group, Anticosti.

Collector.—J. Richardson.

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Sub-genus VANUXEMIA (Billings).

Generic characters.—Ovate; beaks terminal or sub-terminal; posterior extremity rounded; anterior more or less acuminate; two muscular impressions; anterior teeth variable in number, sometimes curved and striated; posterior lateral teeth from two to four.

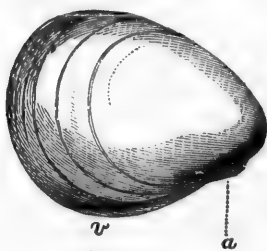
VANUXEMIA INCONSTANS (Billings).

Fig. 15.

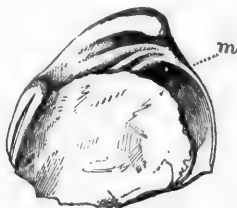


Fig. 16.

Figure 15. Right valve; *v*, ventral margin; *a*, the small anterior ear.

" 16. A fragment shewing the teeth obscurely; *m*, the muscular impression.

Description.—Ovate; moderately convex; beaks terminal gradually expanding from the beaks to the posterior extremity, which is broadly rounded; dorsal margin slightly and uniformly convex from the beaks to the posterior angle; anterior extremity represented by a very small projection beneath the beaks; ventral side regularly rounded, except a short space near the beaks, which is sometimes concave and partly occupied by the small projection of the anterior extremity. Three strong curving anterior teeth; two posterior lateral teeth; shell very thick towards the anterior end; a small area between the beaks; the anterior muscular impresssion is apparently excavated in the edge of the very thick shell. Surface with a few more or less strongly marked concentric furrows of growth. The beaks are short, rounded, and closely incurved.

The proportional length and breadth varies. The specimens are usually an inch and a half in length from the beaks to the posterior extremity, the greatest width from the dorsal to the ventral side being an inch and three or four lines. There is a

small variety, scarcely an inch in length, and more obtuse at the anterior end, than the specimen figured; it is also more ventricose.

Locality and Formation.—Fourth Chute of the Bonne chère, La Petite Chaudière Rapids near the city of Ottawa, and numerous localities in the valley of the Ottawa, associated with fossils of the Black River and Trenton formations.

Collectors.—Sir W. E. Logan, E. Billings, J. Richardson.

VANUXEMIA BAYFIELDII (Billings).

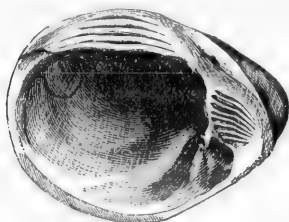


Fig. 17.

Figure 17. Interior of the left valve of *V. Bayfieldii*.

Description.—Very ventricose; ovate; the anterior extremity, including the beaks, narrowly rounded; the posterior end broadly rounded; shell very thick; seven anterior teeth; four posterior teeth; anterior muscular impression large, deep, and excavated in the very much thickened edge of the shell; posterior muscular impression sub-circular, superficial and situated just beneath the posterior extremity of the hinge line.

The specimen figured is deeply imbedded in a coral (*Monticulipora petropolitana*), and only exhibits the edges and inside of the shell. From the great thickness of the shell, casts of the interior must bear very little resemblance to a perfect specimen. The form is very like that of *Vanuxemia inconstans*, but the characters of the interior leave no doubt as to its distinctness.

Locality and Formation.—Bayfield Sound, Lake Huron a single loose specimen; Lower Silurian appears to be of the Hudson River Group.

Collector.—A. Murray.

Genus *MATHERIA* (Billings.)

Generic Characters.—Transverse; equivalve; inequilateral; beaks near the anterior end; dorsal and ventral margins subparallel; two small obtuse cardinal teeth in the left valve, and one in the right; no lateral teeth; two muscular impressions; ligament external.

This genus is dedicated to Mather, one of the Geologists of the New York Survey.

MATHERIA TENER.

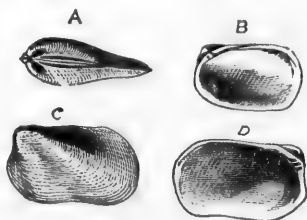


Fig. 18.

Figure 18. A, dorsal view of *Matheria tener*; B, interior of right valve; C, exterior of left valve; D, interior of left valve.

Description.—Small, oblong, depressed; dorsal and ventral margins nearly straight and parallel; upper half of posterior extremity obliquely truncate; lower half rounded; anterior extremity sub-truncate from the beaks nearly to the anterior ventral angle, which is rounded, and projects slightly beyond the umbones. From the beaks to the anterior ventral angle extends a prominent obtusely angular canina; surface marked with fine concentric striae. Width eight lines; length four lines.

Locality and Formation.—Blue Point, Lake St. Johns; Trenton limestone.

Collectors—J. Richardson, R. Bell.

*Genus OBOLUS (Eichwald).**OBOLUS CANADENSIS (Billings).*

Fig. 19.



Fig. 20.

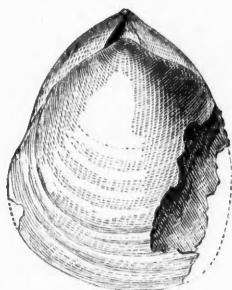


Fig. 21.



Fig. 22.

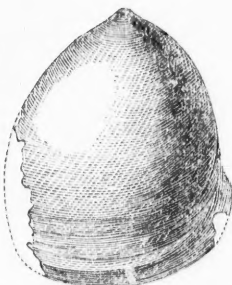


Fig. 23.

Figure 19. Dorsal valve.

20. Interior of dorsal valve.

21. Dorsal view of an elongated specimen which has both valves in place but a little distorted.

22. Side view of the same specimen.

23. Ventral view.

Description.—The form of this magnificent species is somewhat variable, the width being often greater than the length, and sometimes less. Usually, it is transversely broad-oval; the apex of the dorsal valve obtusely angular, and that of the ventral rather acute. The dorsal valve is moderately and pretty uniformly convex; the ventral valve depressed-convex. The beak of the ventral valve projects about two lines above that

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of the dorsal valve, and exhibits a wide, scarcely concave area, with a triangular excavation representing the obsolete foramen; the surface is smooth, or with a few concentric imbricating furrows of growth. In the inside of the dorsal valve there are near, but above the centre, two pyriform muscular impressions, with their pointed extremities close together and directed downwards, while in the upward direction they diverge outwards; they are separated by an obscure rounded ridge, and surrounded on the lower side by an elevated angular border, which forms a projecting point just below their lower extremities. Beneath and close to the hinge there is a narrow and deep flexuous furrow. The muscular impression at the cardinal angles figured by Davidson in *O. Apollinis* (Eichwald), *O. transversa* (Salter), and *O. Davidsoni* (Salter), are very indistinct in this species; the area of the ventral valve does not appear to be striated. The interior of the ventral valve is not clearly shewn in any of our specimens. Width usually about two inches, but some of the fragments undoubtedly belonged to individuals which were three inches wide. The length from the beaks to the base, is either equal to or a little greater or less than the width, the dimensions being variable.

Locality and Formation.—Occurs abundantly at the Fourth Chute of the Bonne chère, Pauquette's Rapids, and in the Townships of Stafford and Westmeath, County of Renfrew, associated with fossils of the Trenton and Black River limestone.

Collectors—Sir W. E. Logan, J. Richardson, and E. Billings

Genus EICHWALDIA (Billings.)

Generic Characters.—Large valve perforated on the umbo for the passage of the peduncle; the place of the foramen beneath the beak occupied by an imperforate concave plate, the interior divided by an obscure medio-longitudinal ridge; interior of smaller valve divided throughout from the beak to the front by a very prominent medio-longitudinal ridge; no hinge, teeth, sockets, or other articulating apparatus in either valve.

After a great deal of examination and comparison I have not been able to refer the species for which the above generic name is proposed to any of the described genera. Although several silicified specimens exhibiting the interior have been obtained, they do not show any muscular impressions. The perforation on the back of the beak was at first supposed to be a fracture, but we have now specimens which exhibit its characters so completely that I do not think it possible there can be any mistake. The internal structure of the larger valve somewhat resembles that of *Pentamerus* or *Camarophoria*, the concave plate beneath the beak appearing to be the homologue of the floor of the triangular chamber found in these genera. I cannot make out however, that it is in any way connected with the medio-longitudinal ridge as is the case in both *Pentamerus* and *Camarophoria*. In removing the limestone from silicified specimens the delicate processes in the interior of species of brachiopoda are very often destroyed, and it is possible that the connection in question may exist in perfect specimens, but not appear after treatment with acids. It is therefore uncertain whether or not it is attached to the plate beneath the beak. If it should be hereafter ascertained that it is so connected, the foramen on the umbo would still be sufficient to show that this is a new genus, to the establishment of which the characters of the smaller valve and the absence of any articulating and apophysary apparatus would be additional characters. As other specimens can be procured and as the internal characters cannot be well shewn by wood-engraving, I shall for the present give figures of the exterior only.

EICHWALDIA SUBTRIGONALIS (Billings.)

Description.—Sub-triangular; both valves moderately convex and smooth, apical angle about ninety degrees or a little less; sides from the beak to about one half the length straight, then rounded; front more or less broadly rounded; beak of larger valve extended, incurved at the point and with a moderately large concave area; beneath beak of smaller valve strongly

Fig.

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incurved apparently entering the visceral cavity beneath the area of the larger valve; length and width about equal.

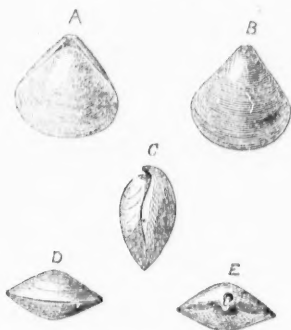


Fig. 24.

Figure 24. A, dorsal view; B, ventral; C, side; D, front; E, apex, shewing the foramen.

Locality and Formation.—Fourth Chute of the Bonne-chère and Pauquette's Rapids, associated with numerous fossils of the Black River and Trenton Formations.

Collectors—Sir W. E. Logan, J. Richardson, E. Billings.